TROPICAL FOREST NOTES

INSTITUTE OF TROPICAL FORESTRY *
RIO PIEDRAS, PUERTO RICO

No. 14

SOLAR RADIATION USED TO DRY MAHOGANY LUMBER IN PUERTO RICO

By
Edwin D. Maldonado

The woodworking industries of Puerto Rico are dependent upon imported lumber, most of which is not air-dry when it reaches the Island. None of the local furniture or millwork plants possess adequate facilities for drying lumber, neither an air-drying yard nor a dry kiln. Even storage space is inadequate, so the common practice is to store lumber in solid piles out-of-doors with no protection from damp local climate. Lumber from such piles usually enters the production line with no attention to moisture content. This practice causes difficulties when manufactured items are placed in service.

Results of recent research on solar drying at the Forest Products Laboratory, Madison, Wisconsin, led to the construction of the first solar dryer in the tropics in Puerto Rico in October, 1961. A pilot dryer with a capacity of 2,000 board feet of lumber was constructed at a location subject to day-long sunlight on the grounds of the Institute at Río Piedras (Fig. 1).

The results of the first two test runs with this dryer are promising. In the first test the solar dryer was loaded with 5/4 upper grade Mexican mahogany (Swietenia macrophylla King). The initial moisture content of the lumber in this test was 50 percent. The mean drying rate of four samples was used in determining the average moisture contents. The moisture content dropped to 12 percent in 23 days, having lost 38 percent during this period. The air dried lumber, on the other hand retained 27 percent moisture at this time, having lost only 23 percent. In terms of moisture loss, the rate was nearly twice as rapid in the dryer. Moreover, the solar dryer reduced the moisture content below that ever attainable by air drying in this climate. Actually the decline in the air-dried pile had slowed almost to a standstill near the end of this rainy period. Nevertheless, moisture loss in the dryer continued to a level of 8.5 percent after 29 days (Fig. 2).

The second test was with 4/4 Mexican mahogany at an initial moisture content of 32 percent. The moisture content dropped to 12 percent in 13 days, and 8.6 percent after 25 days. No comparable air drying pile was made at this time (Fig. 3).

Comparing the two graphs, it is seen that the decline from 32 percent to 12

---

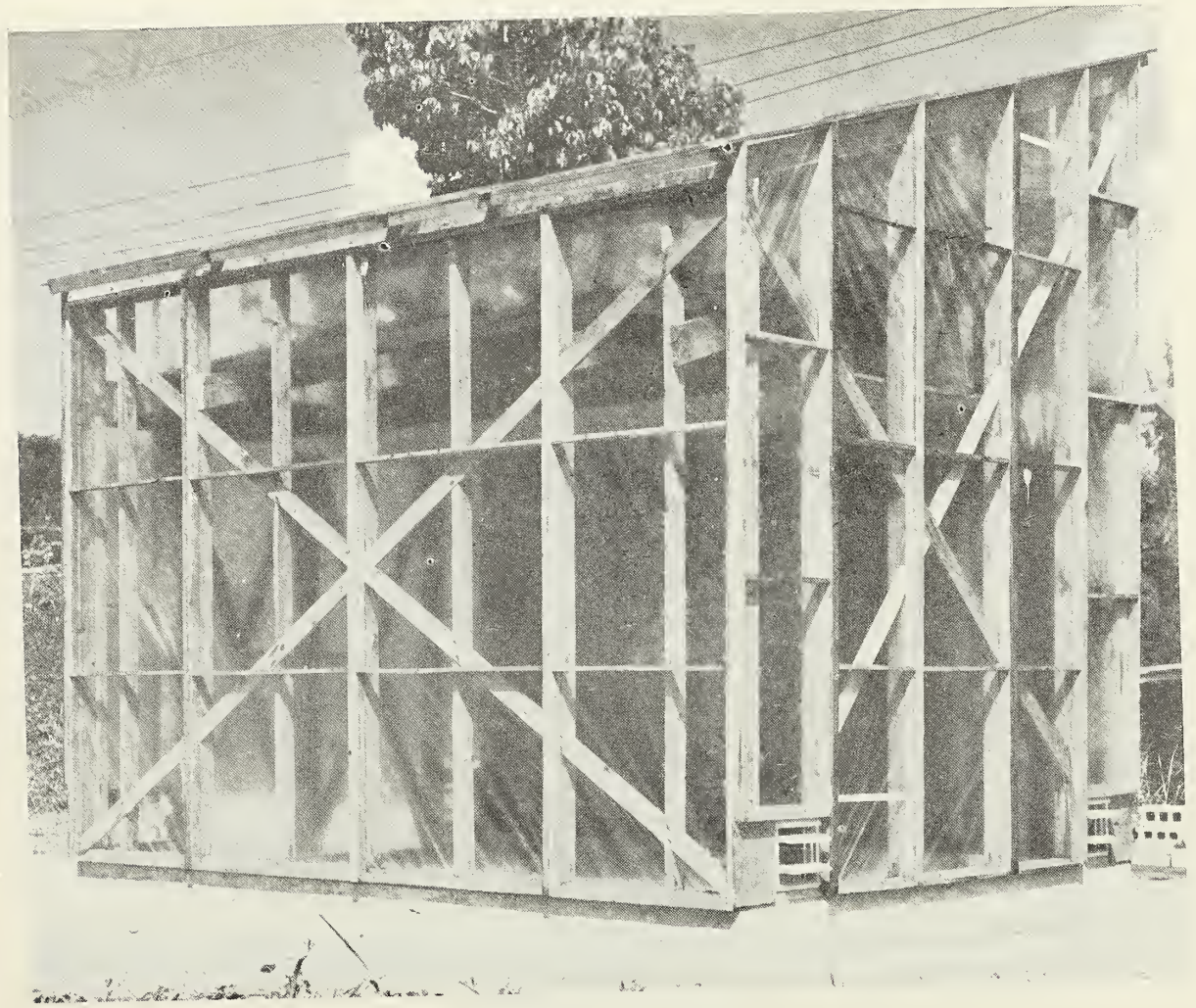
* Operated in cooperation with the University of Puerto Rico.

percent took 19 days in the first test, but only 13 days in the second. This difference was in spite of the smaller volume of lumber and the higher temperatures prevailing during the first test. The difference may be partly due to thickness of the material (5/4 vs. 4/4), but the main reason is probably the contrast in rainfall and outdoor humidity during the two periods. During the first test, rain fell on 16 of the 19 days, a total of 13.22 inches, and the mean 2 PM relative humidity was 73 percent. For the 13 corresponding days of the second test, rain fell on 10 days, but the total was only 0.51 inch, and the mean 2 PM relative humidity was only 63 percent.

The experiments were conducted during the late fall and winter, the least favorable time of the year. Air temperatures outside the dryer ranged from 66.1°F to 86°F. Temperature inside the dryer averaged 28°F higher than outside, with a maximum of 40°F attained on two occasions. The highest temperature recorded inside the dryer was 122°F with an outside temperature of 82°F. More rapid drying rates are anticipated during the warmer part of the year, especially from April to September.

Solar dryers may prove to be a good substitute for kilns in the tropics. They provide a convenient, inexpensive means for drying lumber.

December 20, 1962



THE SOLAR DRYER

Figure 1

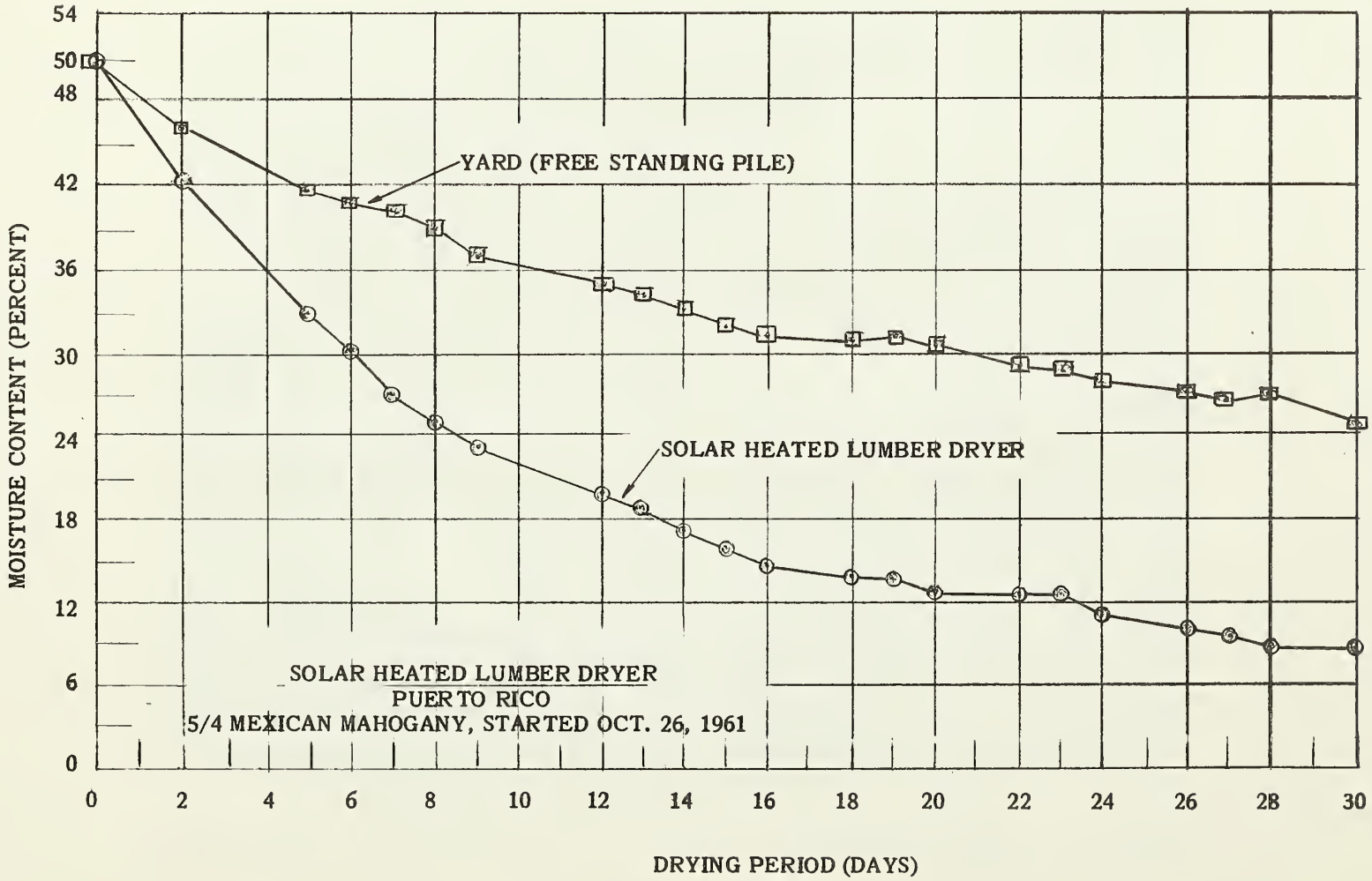

MOISTURE CONTENT (PERCENT)
54
50
48
42
36
30
24
18
12
6
0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
YARD (FREE STANDING PILE)
SOLAR HEATED LUMBER DRYER
SOLAR HEATED LUMBER DRYER
PUERTO RICO
5/4 MEXICAN MAHOGANY, STARTED OCT. 26, 1961
DRYING PERIOD (DAYS)

Figure 2

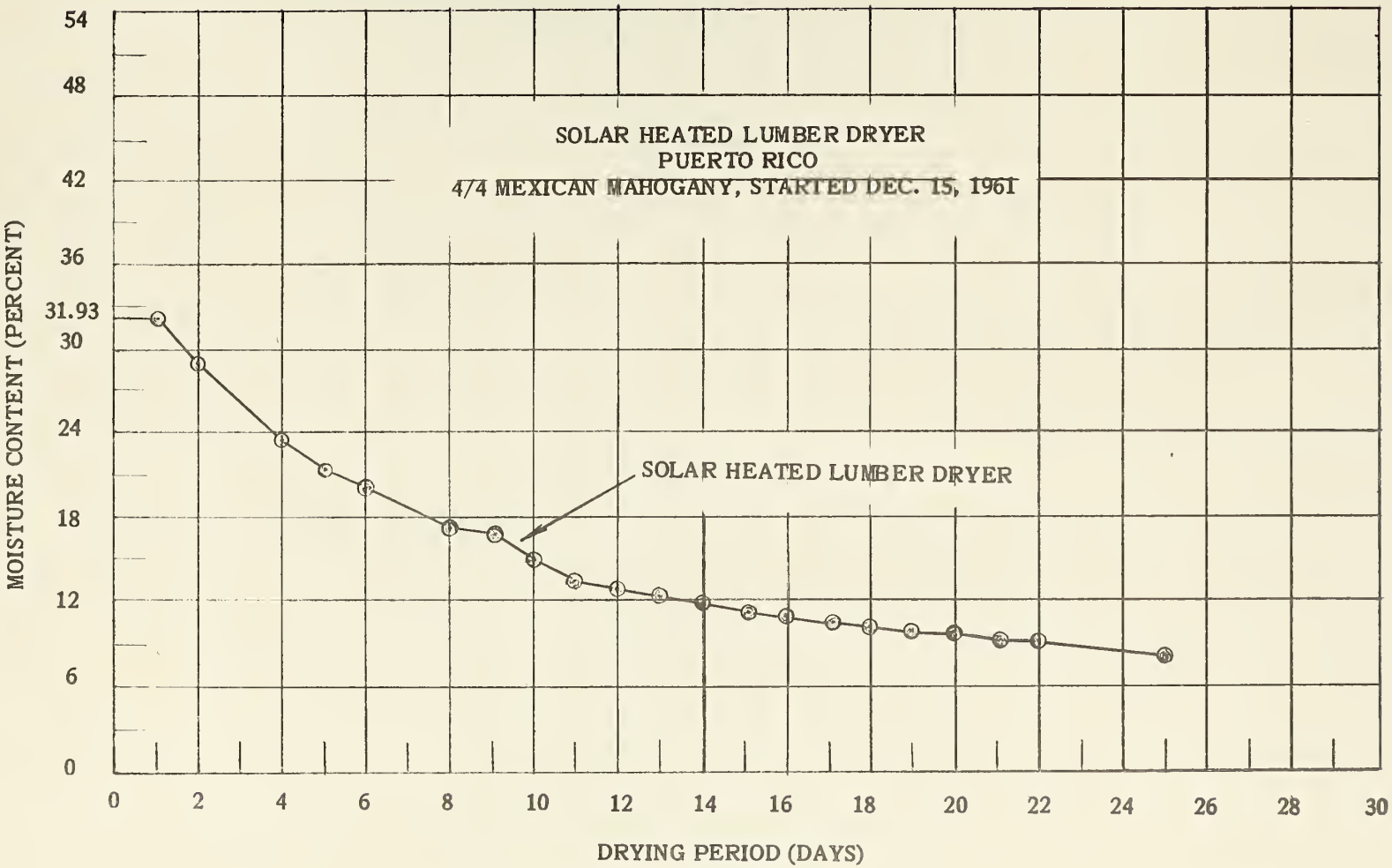

SOLAR HEATED LUMBER DRYER
PUERTO RICO
4/4 MEXICAN MAHOGANY, STARTED DEC. 15, 1961
SOLAR HEATED LUMBER DRYER
MOISTURE CONTENT (PERCENT)
54
48
42
36
31.93
30
24
18
12
6
0
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
DRYING PERIOD (DAYS)

Figure 3